

Definitions

Discrete : Different, independents, separate, not of same type

Discrete Mathematics (discrete structures) : Mathematical topic that are different, independents, separate, not of same type

Integer : whole number without fraction

Even : even integer

Odd : odd integer

At least : same or more (more means bigger by value)

At most : same or less (less means smaller by value)

Non-negative: 0 or positive

Non-positive : 0 or negative

Increasing sequence : left to right values are always bigger (same not allowed)

Non-decreasing sequence : left to right values are same or bigger

Decreasing sequence: left to right values are always smaller (same not allowed)

Definitions (cont)

Non-increasing sequence : left to right values are same or less

rational number : can be represented by the fraction (ratio) of two integers as p/q , where q is non-zero

irrational number : is a number that cannot be represented by a ratio of two integers

Real numbers : include integers, rational and irrational numbers

Decimal number : the number that we usually see and use (0, 1, 2...9)

Binary number : number has only two digits, (0 and 1)

Absolute value of a number : is its value without sign

Equality : is another name of mathematical equation

Factorial : of a non-negative integer n (written as $n!$)

Definitions (cont)

mod (also called modulus) of two integers a mod b is the remainder after a is divided by b

At least and At most

At least :

example 1: At least 12 (means 12 or more)
12 , 13 , 13.5 , 1000 etc

example 2 : At least -4
-4 , -3.5 , 0 , 4 etc

At most :

example 1: At most 12 (means 12 or less)
12 , 11.99 , 10 , 0 , -1 etc

example 2 : At most -4
-4 , -4.1 , -5 , -10 etc

Definitions

Inequality means if the expression has no " $=$ ". Instead, it has $<$, $\neq$, $>$, $\geq$, $\leq$ etc.

Although $\geq$ and $\leq$ have " $=$ " within them, they are still inequalities

Definition of **log** is this: If $a^x = y$, then $x = \log_a y$



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Some warmup preliminaries

> and $\geq$: If $a > b$ is correct, then $a \geq b$ is also correct

If $a \geq b$ is correct, then $a > b$ may not be correct, because it may happen that $a = b$

<, -, and Inverse

If $a < b$ is correct, then $-a > -b$ is correct,

Inverse of x is $\frac{1}{x}$

If $a < b$ is correct, then (inverse of a) $>$ (inverse of b) is correct, that means, $\frac{1}{a} > \frac{1}{b}$ is correct

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Odd, even Integers

Addition and subtraction

Not same type = odd

even + odd = odd.

even - odd = odd.

odd - even = odd.

Same type = even

odd + odd = even.

even + even = even.

odd - odd = even.

even - even = even.

$\frac{\text{odd} + \text{odd}}{2} = \text{odd or even}$

$\frac{\text{even} + \text{even}}{2} = \text{odd or even}$

$\frac{\text{even} + \text{odd}}{2}$ = Fraction (not even or odd because is not an integer)

Addition and subtraction

Plus or minus one

odd + 1 = even

odd - 1 = even

even + 1 = odd

even - 1 = odd

Even = $2k$

Odd = $2k+1$

(for some integer k . k may be even or odd)

0 is even

Odd, even Integers

multiplication

Not same type = even

odd * even = even.

Same type = itself

odd * odd = odd.

even * even = even

division

even/2 = may be even, may be odd!

exponential

odd

(even or odd)^{odd} = odd

(odd)^{odd} = odd

even

(even)^{positive even} = even.

(even)^{positive odd} = even.

Note Non-negative and Non-positive

0 is not positive, not negative

Non-negative and **at least 0** are same

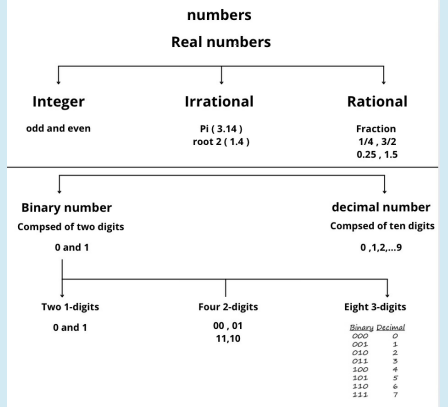
Non-positive and **at most 0** are same

Increasing and decreasing

increasing	L to R value are always bigger same not allowed type: 1 \ increasing values with same increase speed (rate) 2 \ increasing curve with different increasing speed at different places
Non-decreasing	L to R value are same or bigger same allowed Increasing sequence is also non-decreasing
Decreasing	L to R value are always smaller same not allowed type: 1 \ decreasing values with same decreasing speed (rate) 2 \ decreasing curve with different decreasing speed at different places
Non-increasing	L to R value are same or smaller same allowed decreasing sequence is also non-increasing

The term **increasing** usually come with **sequence**

Numbers



Binary numbers have equivalent decimal values

For example: 00, 01, 10, 11 are equivalent to 0, 1, 2, 3

log

Some **common formula** for log (here $a, b, c > 0$):

- $\log_a a = 1$
- $b^{\log_b a} = a$
- $\log_a b^n = n \log_a b$
- $\log_a (bc) = \log_a b + \log_a c$
- $\log_a (1/b) = -\log_a b$
- Next here $\rightarrow$
- $\log_a b = \frac{\log_c b}{\log_c a}$
- $\log_a b = \frac{1}{\log_b a}$
- $a^{\log_b c} = c^{\log_b a}$



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Ceil and floor

Floor

$\lfloor k \rfloor = k$, if k Integer
 $\lfloor k \rfloor =$ previous integer, if k fraction

Ceil

$\lceil k \rceil = k$, if k Integer
 $\lceil k \rceil =$ next integer, if k fraction

mod

It is also written as $a \% b$

(any even integer) $\% 2 = 0$
(any odd integer) $\% 2 = 1$

Mod means remainder

even $\% 2 = 0$

odd $\% 2 = 1$

C

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